

Estimated Annual Habitat



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Problem Statement

All projects that are required to provide “multiple benefits” or have “co-equal” goals need succinct and replicable methods for evaluating functionality for ecologic purposes.



Goals for the metric

- Useful both as a screening and design tool.
- Adapted to measure habitat/benefit for a variety of species/objectives.
- Easily applied: standard tools and available data.
- Transparent and replicable



Linked to Measurable Objectives

- To have measurable objectives, there must be some criteria to measure
- By creating a method that uses the same input as flood damage models it is an easy way to transform existing data into a metric that can measure progress and/or damage for sensitive species.



Initial Approach: Borrowing Ideas ?

Inspiration

Intensity (Depth)-
Duration-Frequency
Curves in Hydrology



New Metric

Area-Duration-Frequency
Curves for Habitat

Estimated Annual
Damage in Flood
Risk Analysis



Estimated Annual Habitat

Inputs

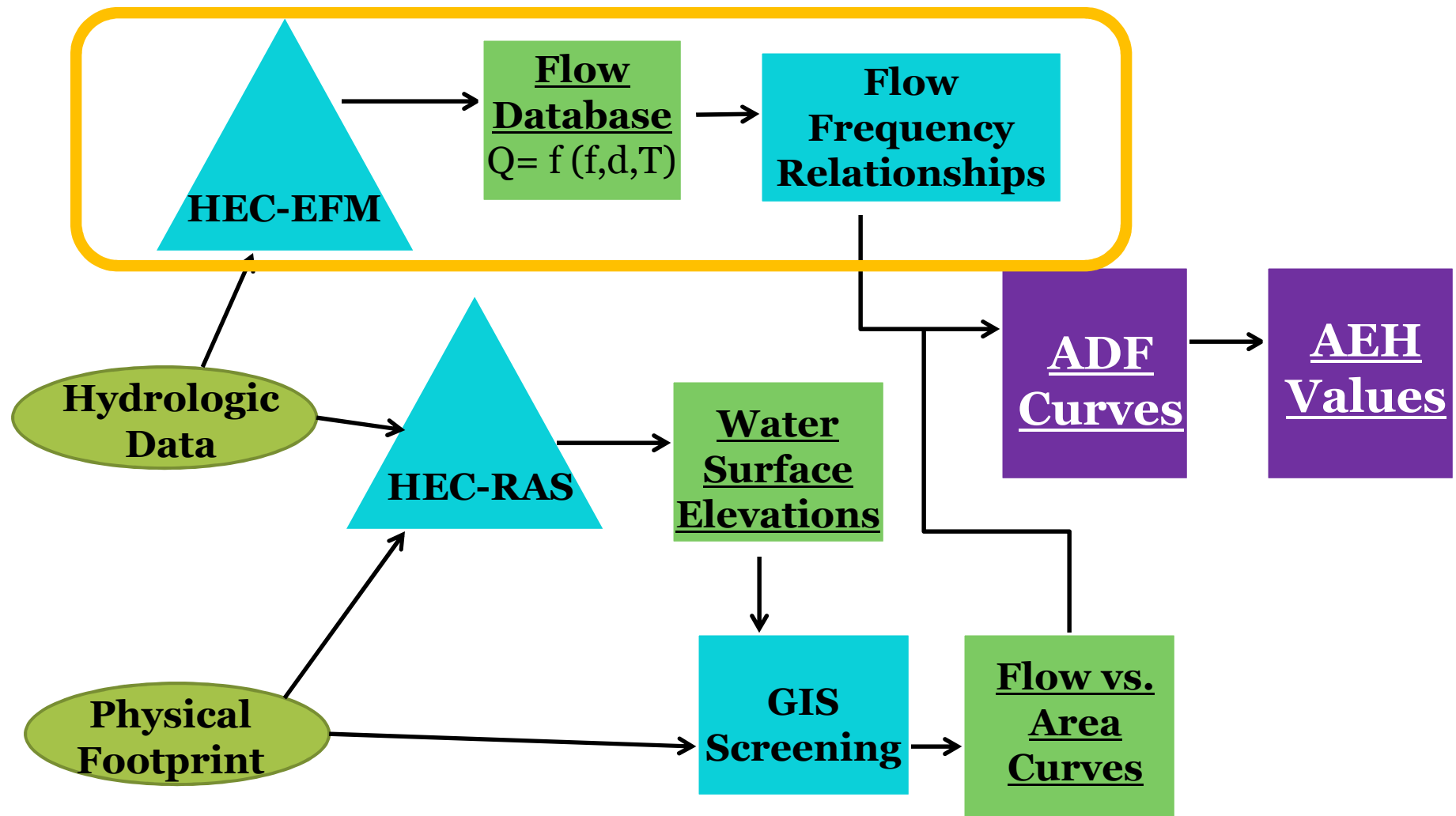
- Required
 - Hydrologic records
 - Topographic data
 - Species preferences
- Optional
 - Land cover
 - Vegetation



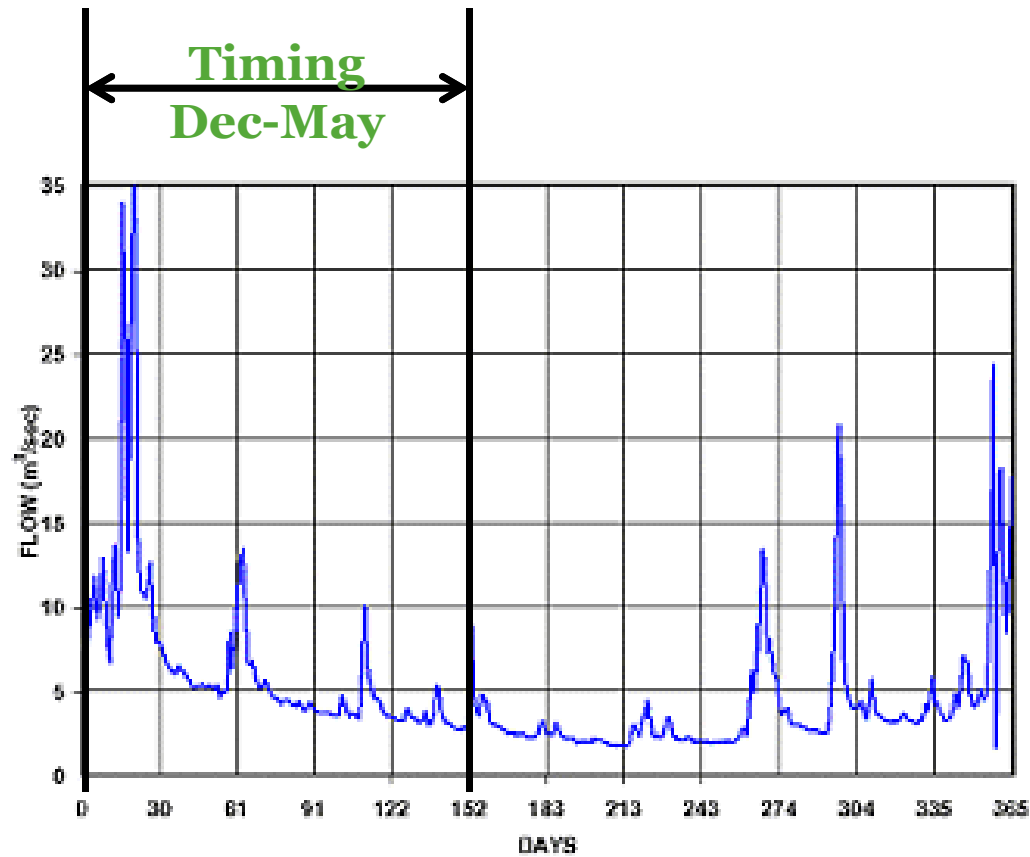
Ecosystem Relationships

Ecological Relevance	Season	Duration	Frequency
Splittail spawning and rearing	Feb – May	At least 21 days	At least 4 yr return period
Chinook salmon rearing	Dec – May	At least 14 days	At least 2 yr return period
Phytoplankton production	Dec – May	At least 2 days	1.3 yr return period
Zooplankton production	Dec – May	At least 14 days	1.3 yr return period
Benthic macroinvertebrate production	Dec – Sep	At least 1 day	2 yr return period

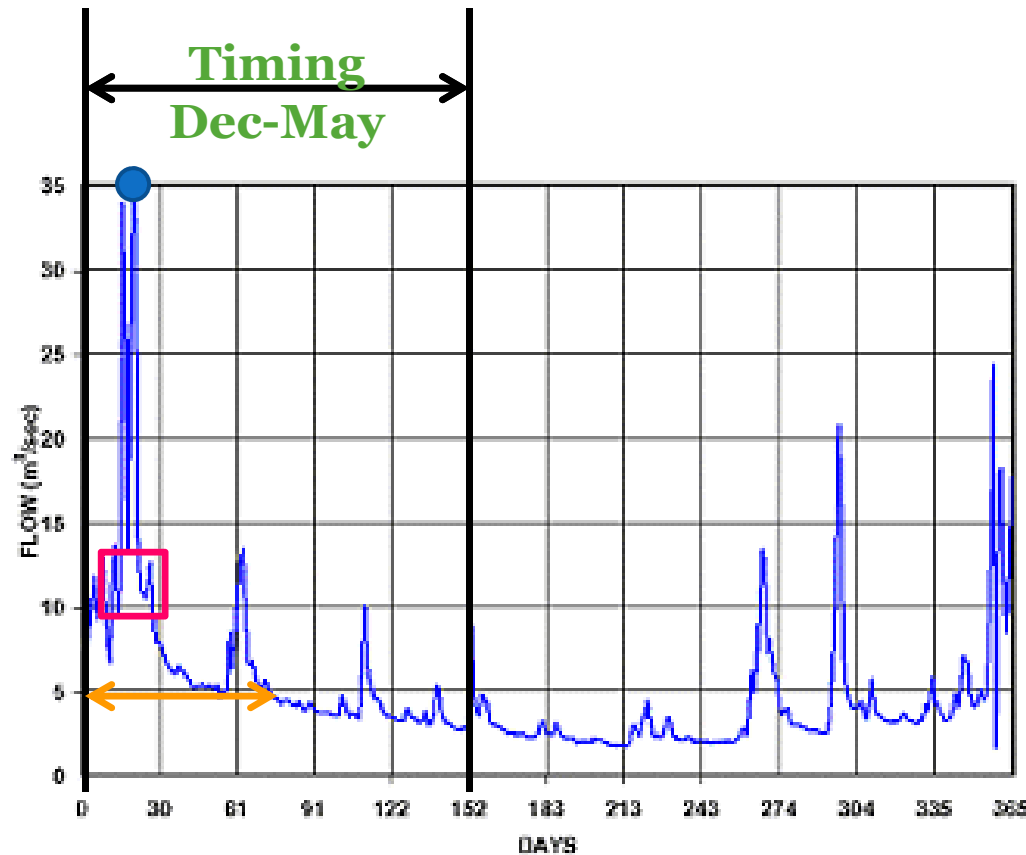
Method Flow—Inputs hydrologic



HEC-EFM: Hydrologic Statistics



HEC-EFM: Hydrologic Statistics



Durations

1-Day

3-Day

7-Day

14-Day

21-Day

28-Day

60-Day

HEC-EFM: Hydrologic Statistics

Durations

1-Day

3-Day

7-Day

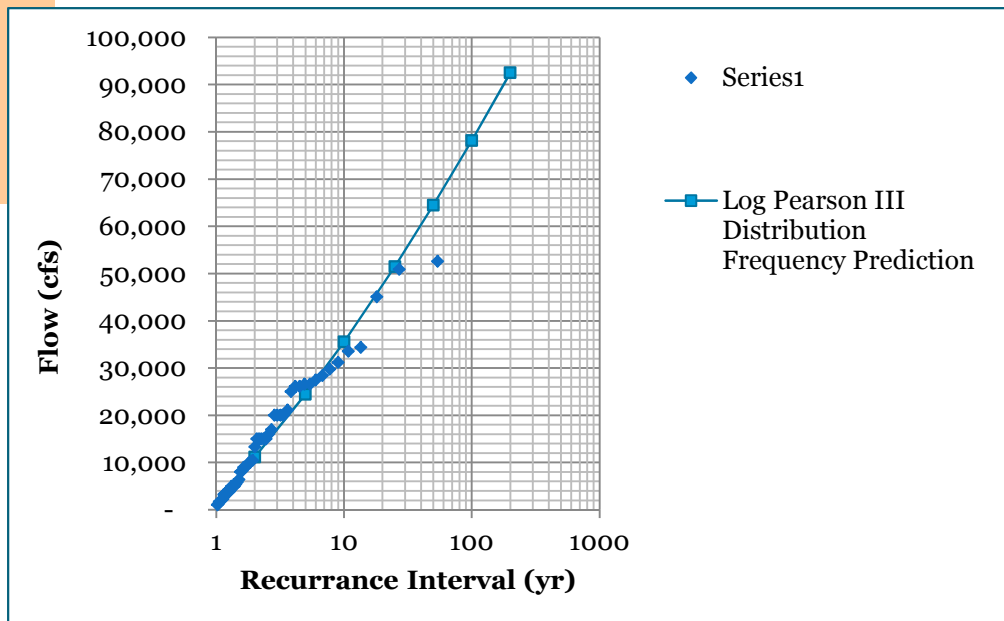
14-Day

21-Day

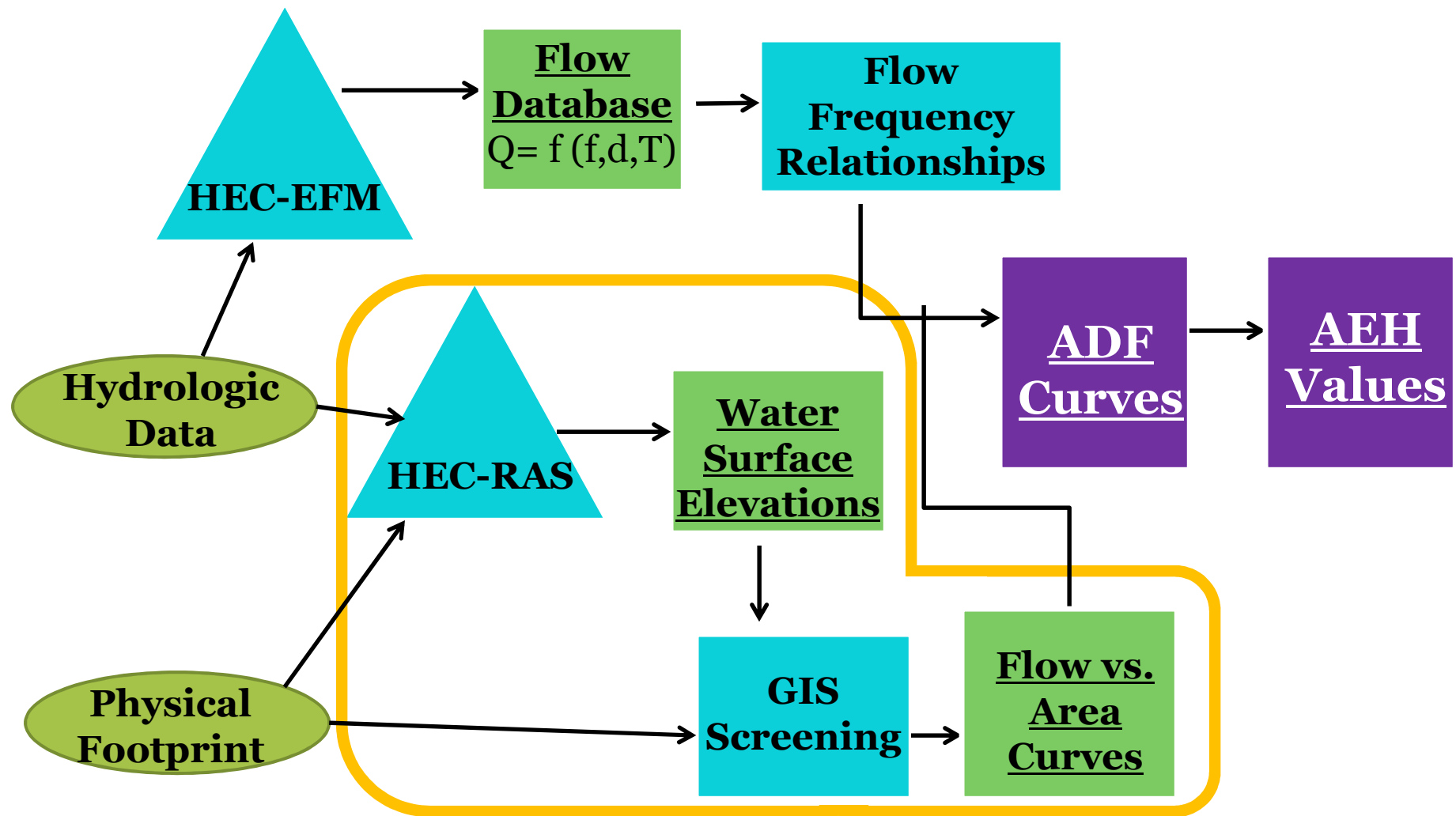
28-Day

60-Day

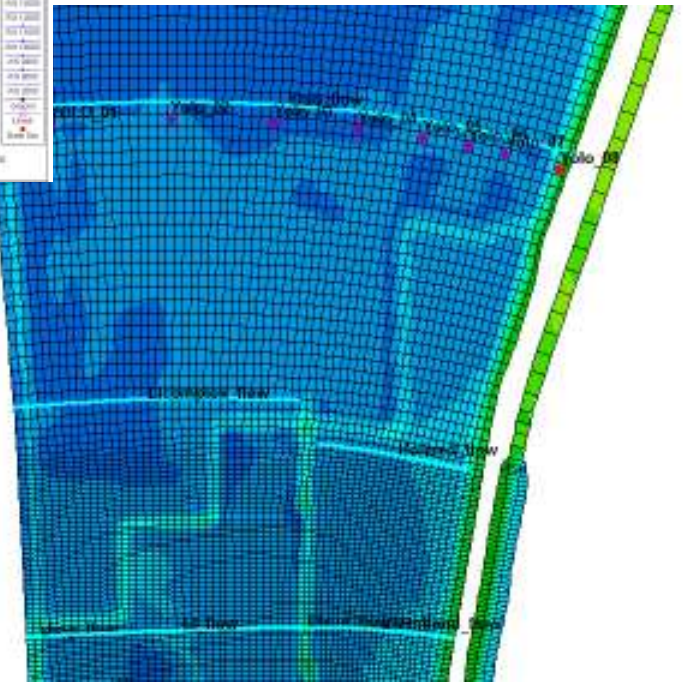
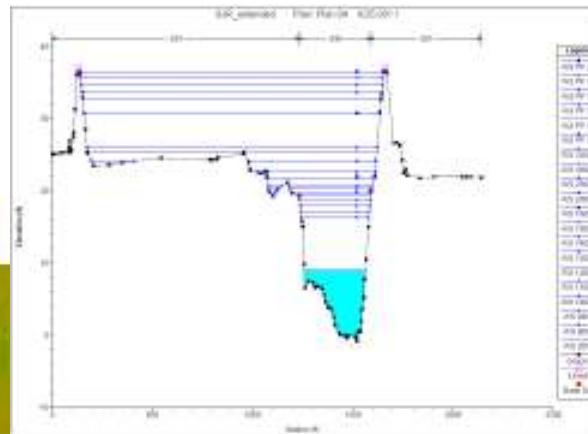
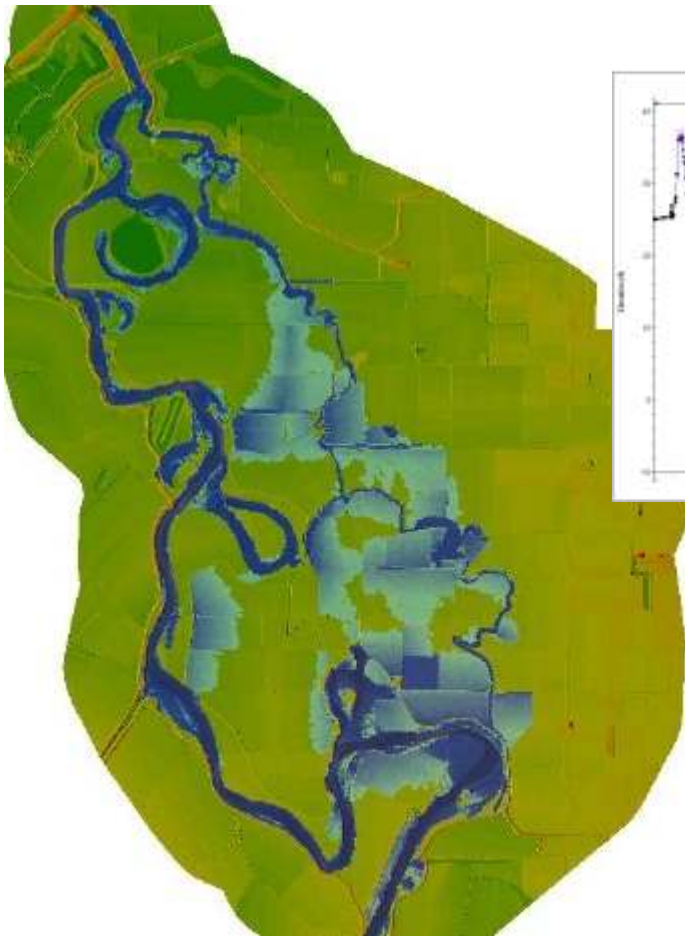
RANK	PEAK_FLOW_V ALUE_Q(cfs)	LOGQ_cfs	(log Q – avg(logQ))^2	(log Q – avg(logQ))^3	Return Period (n+1)/m	Exceedence Probability (1/Tr)
1	52,600	4.721	0.4959	0.3492	54.00	0.019
2	50,900	4.707	0.4760	0.3284	27.00	0.037
3	45,100	4.654	0.4063	0.2589	18.00	0.056
4	34,400	4.537	0.2702	0.1404	13.50	0.074
5	33,598	4.526	0.2596	0.1323	10.80	0.093
6	31,201	4.494	0.2279	0.1088	9.00	0.111
7	29,800	4.474	0.2092	0.0957	7.71	0.130
8	28,400					
9	27,500					
10	26,599					
11	26,599					



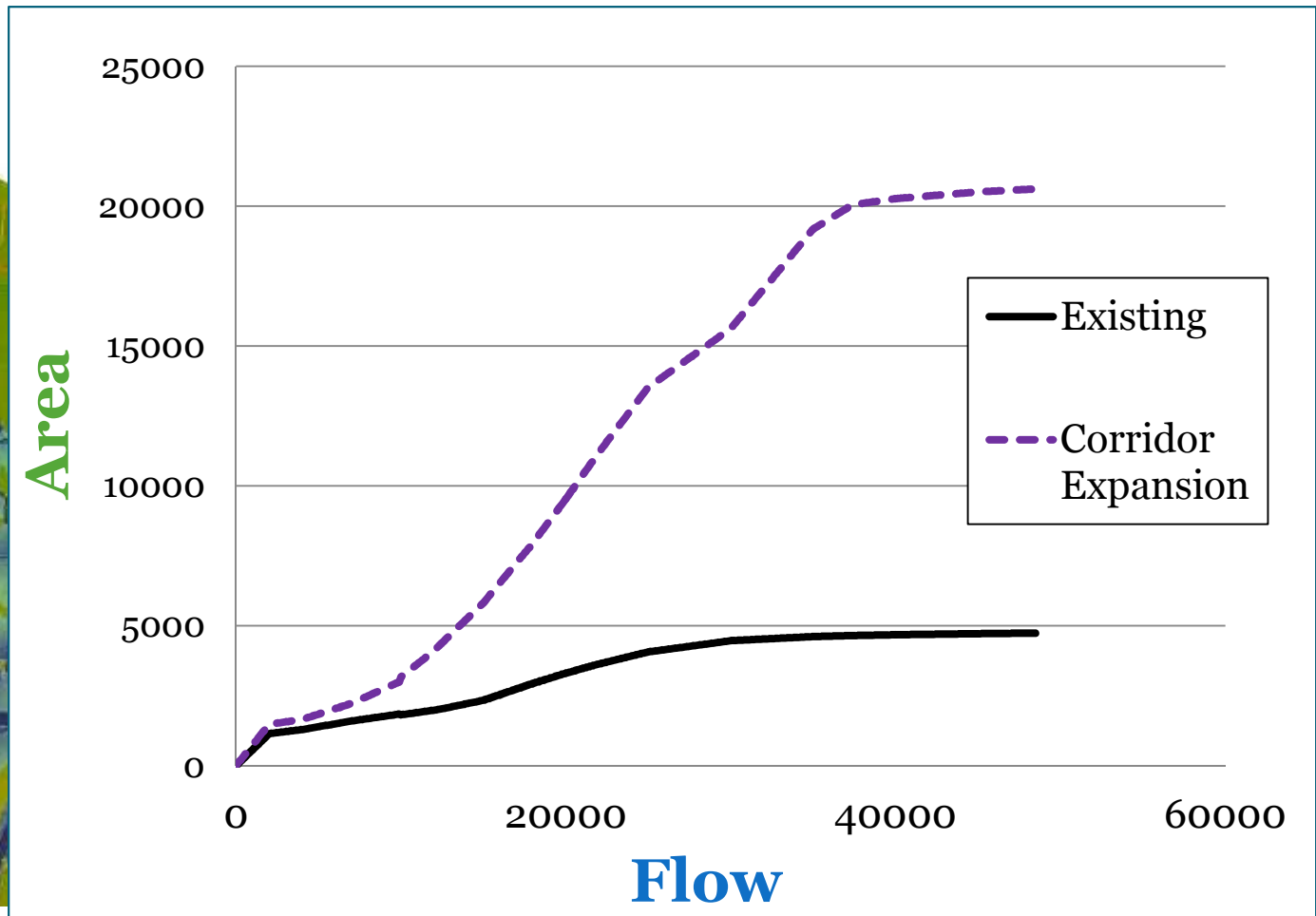
Method Flow—Inputs Hydraulic



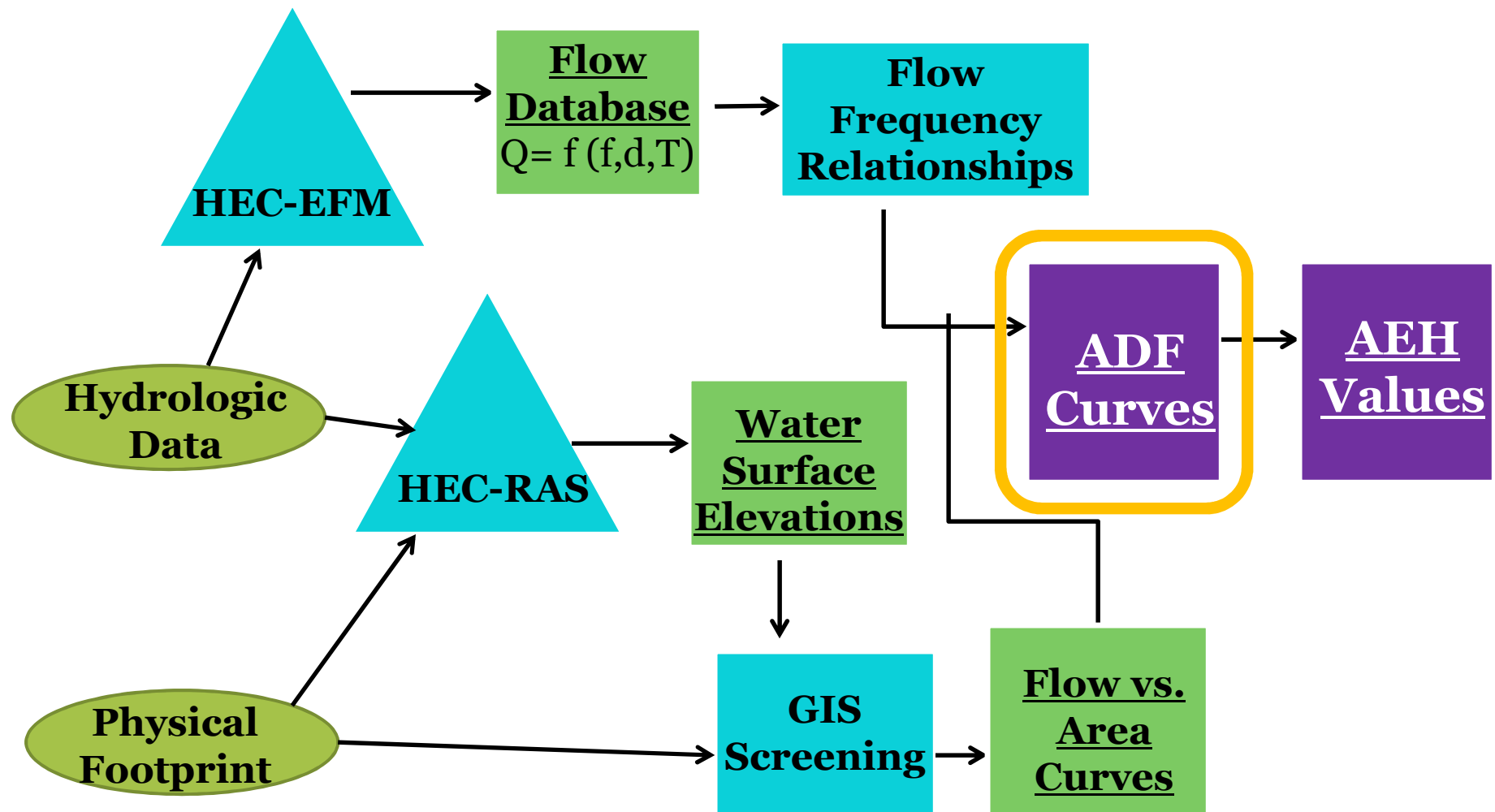
HEC-RAS and other hydraulic models



HEC-RAS and other hydraulic models



Method Flow—Outputs and Results



ADF Curves: Definition

Intensity-Duration-Frequency Curves in Hydrology }

Defines the variable we are interested in for design (intensity) as a function of duration and frequency.

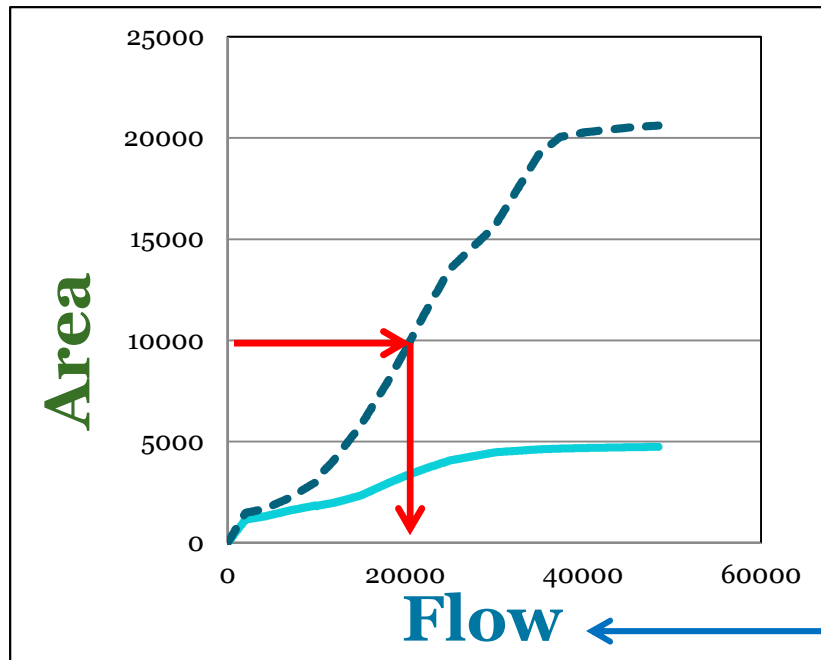


Area-Duration-Frequency Curves }

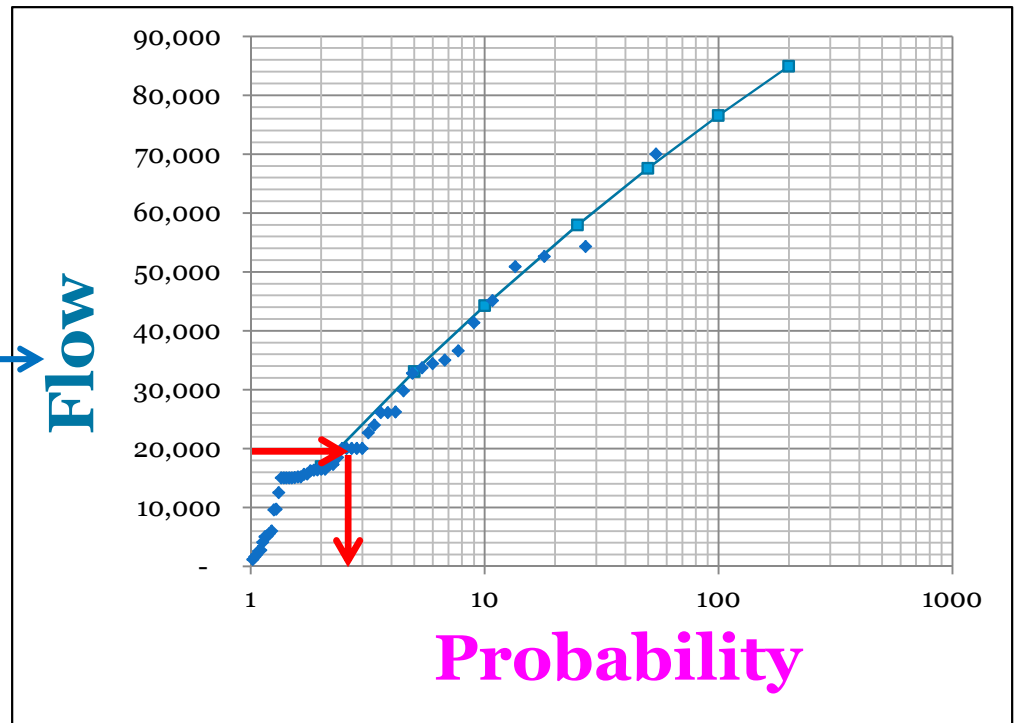
Defines the variable we are interested in for design (quantity of functional habitat) as a function of duration and frequency.

Develop ADF Curves

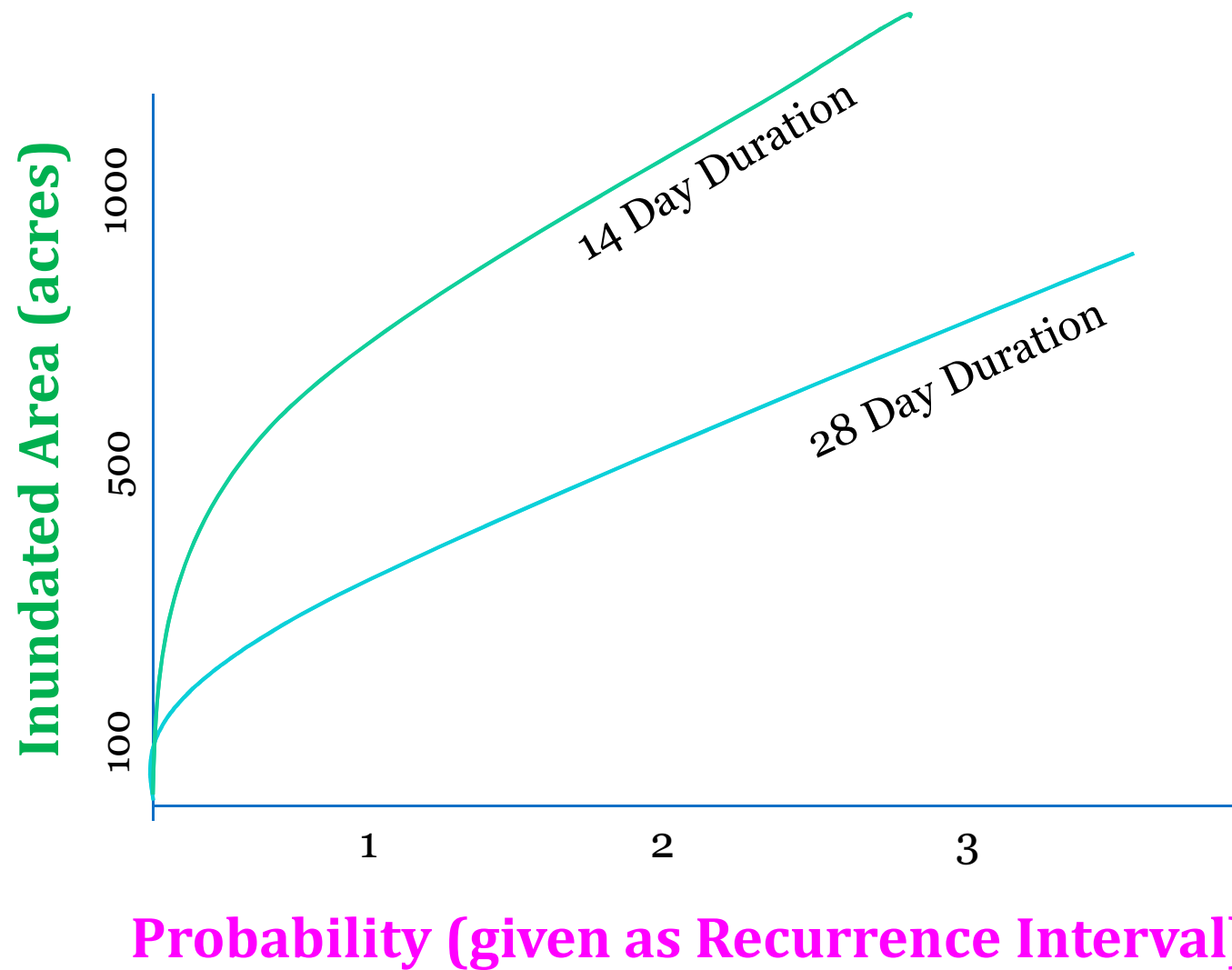
Q vs Area Curves



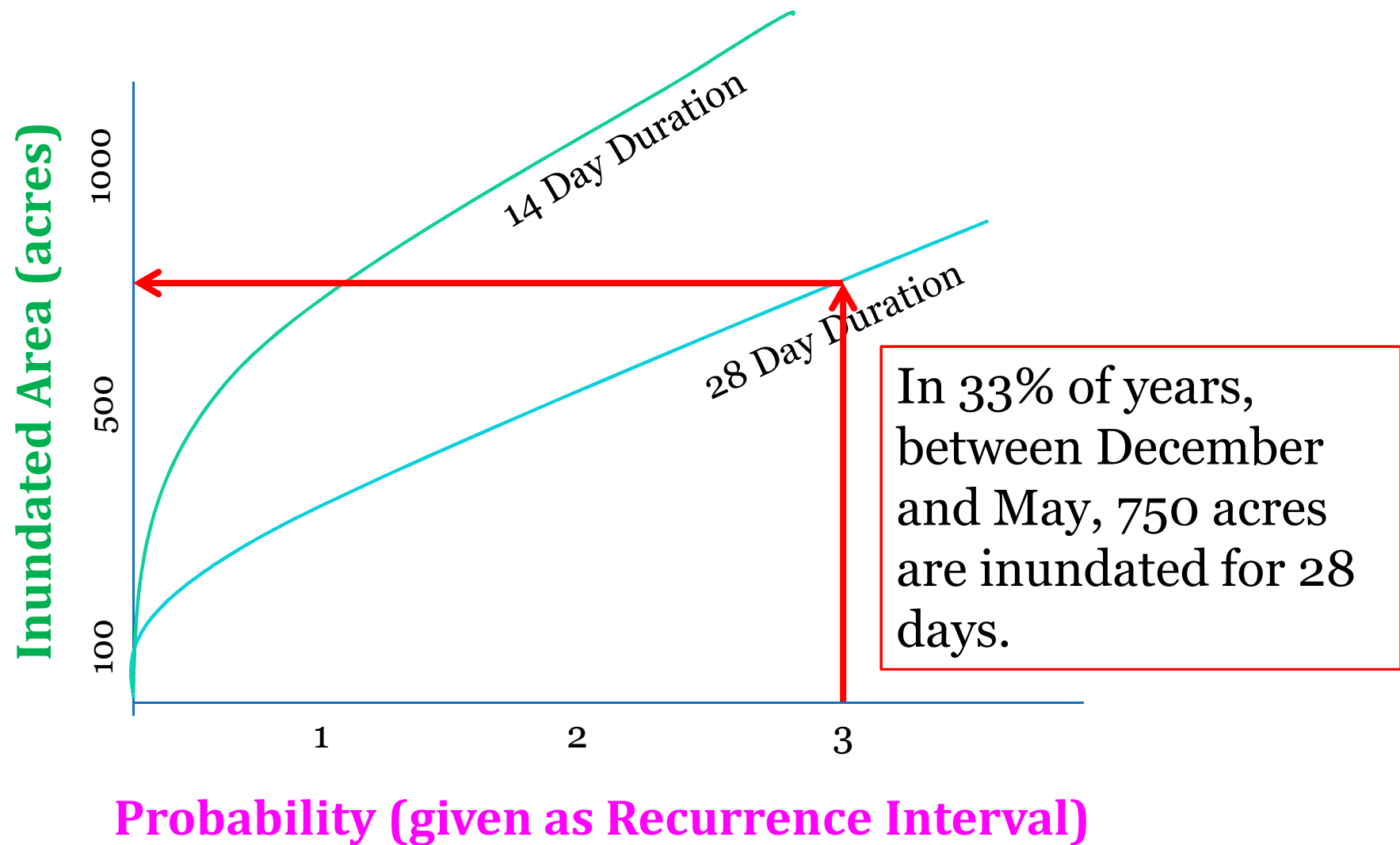
Recurrence Interval Functions



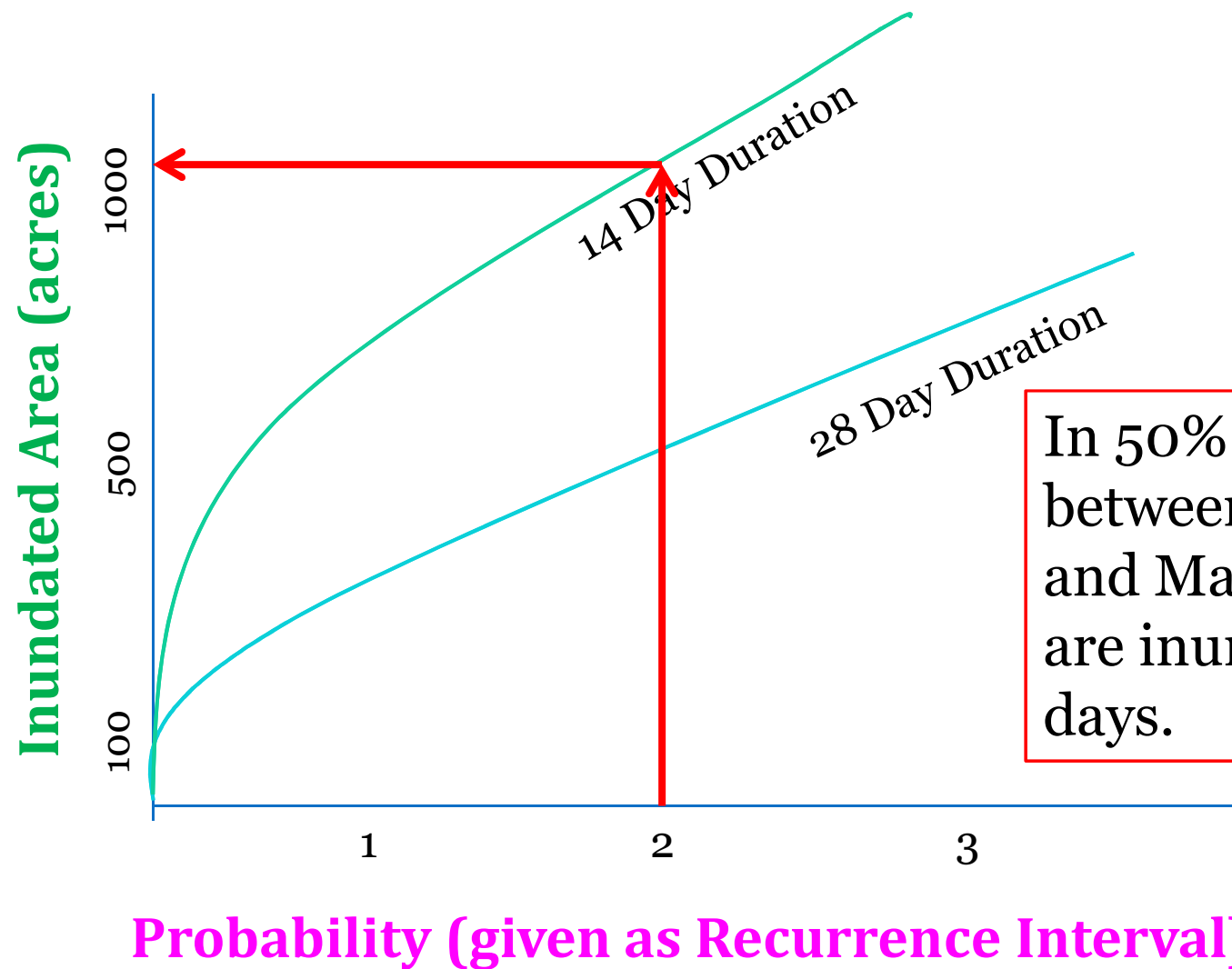
Develop ADF Curves



Develop ADF Curves

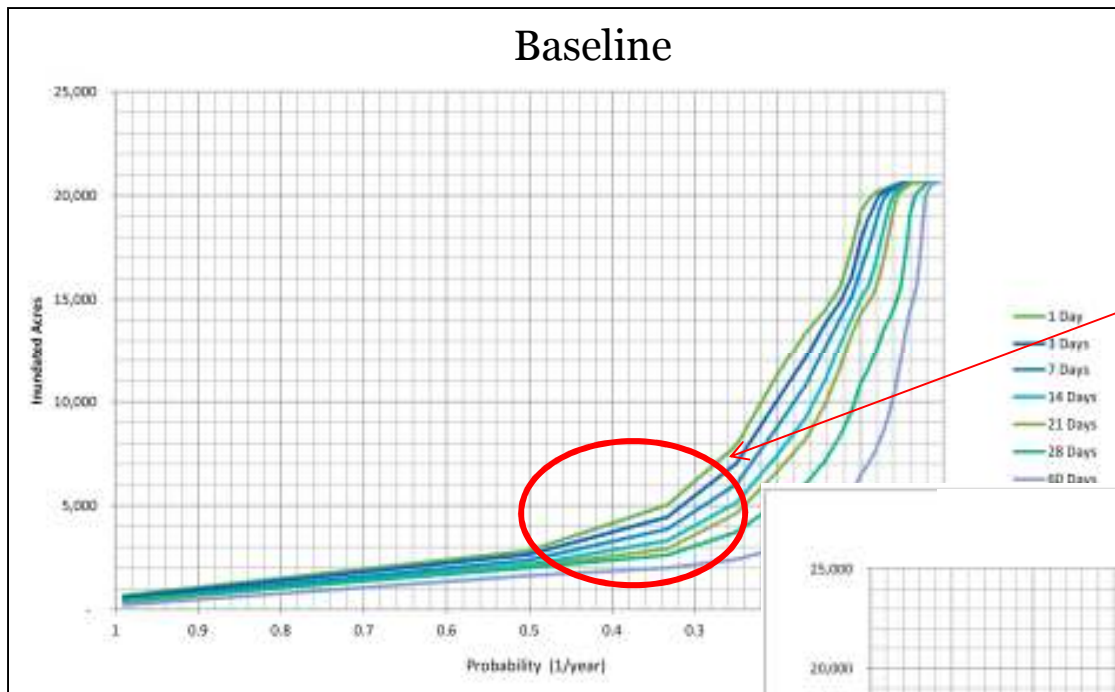


Develop ADF Curves



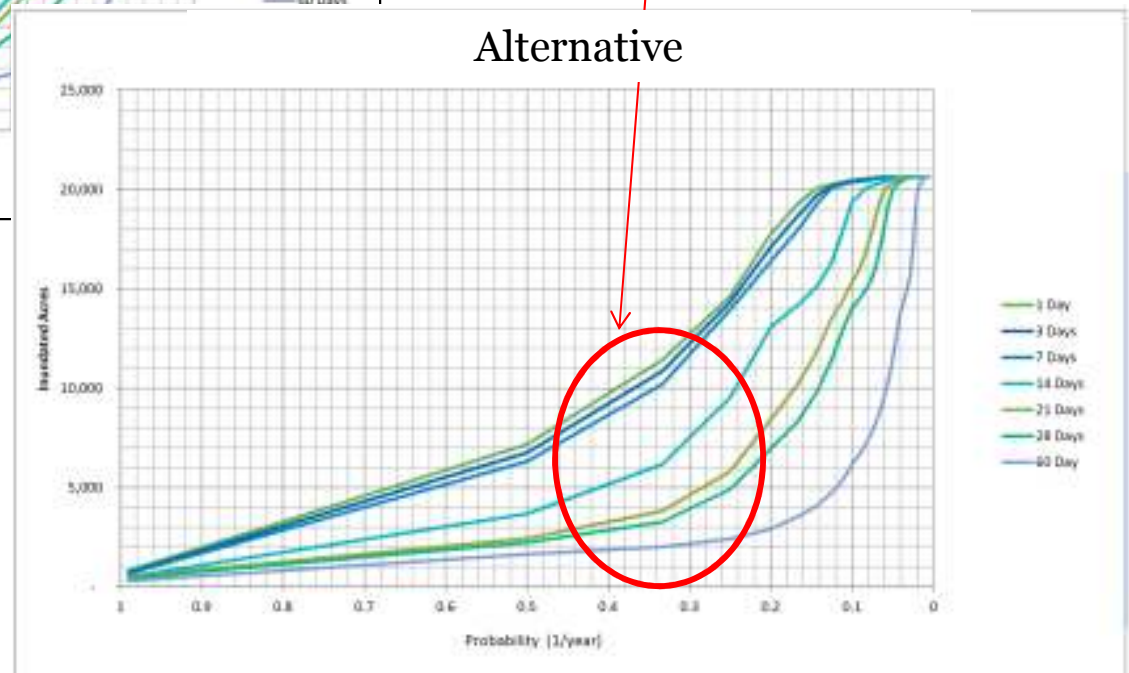
ADF Curves: Example

Baseline

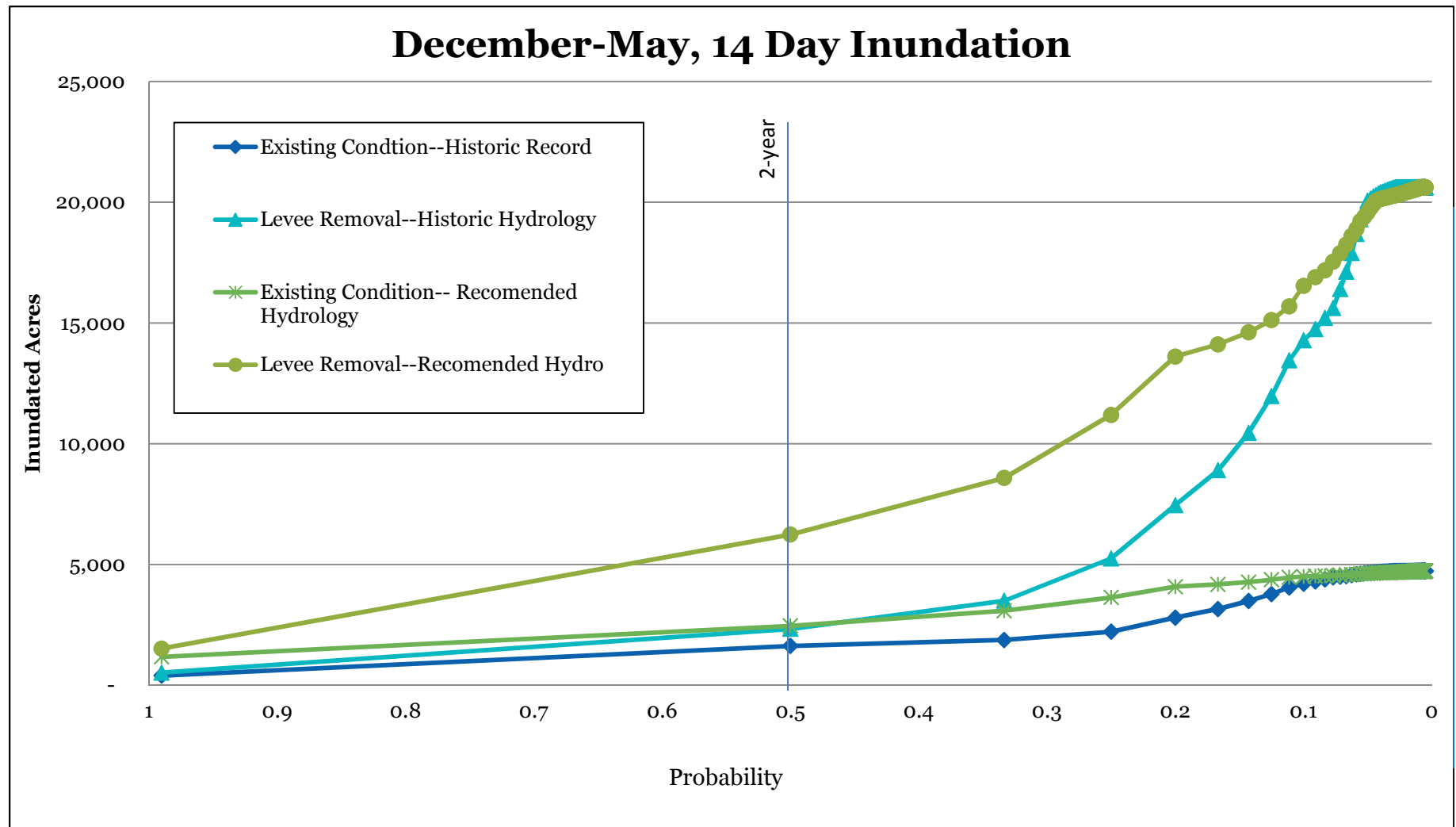


Benefit of Actions

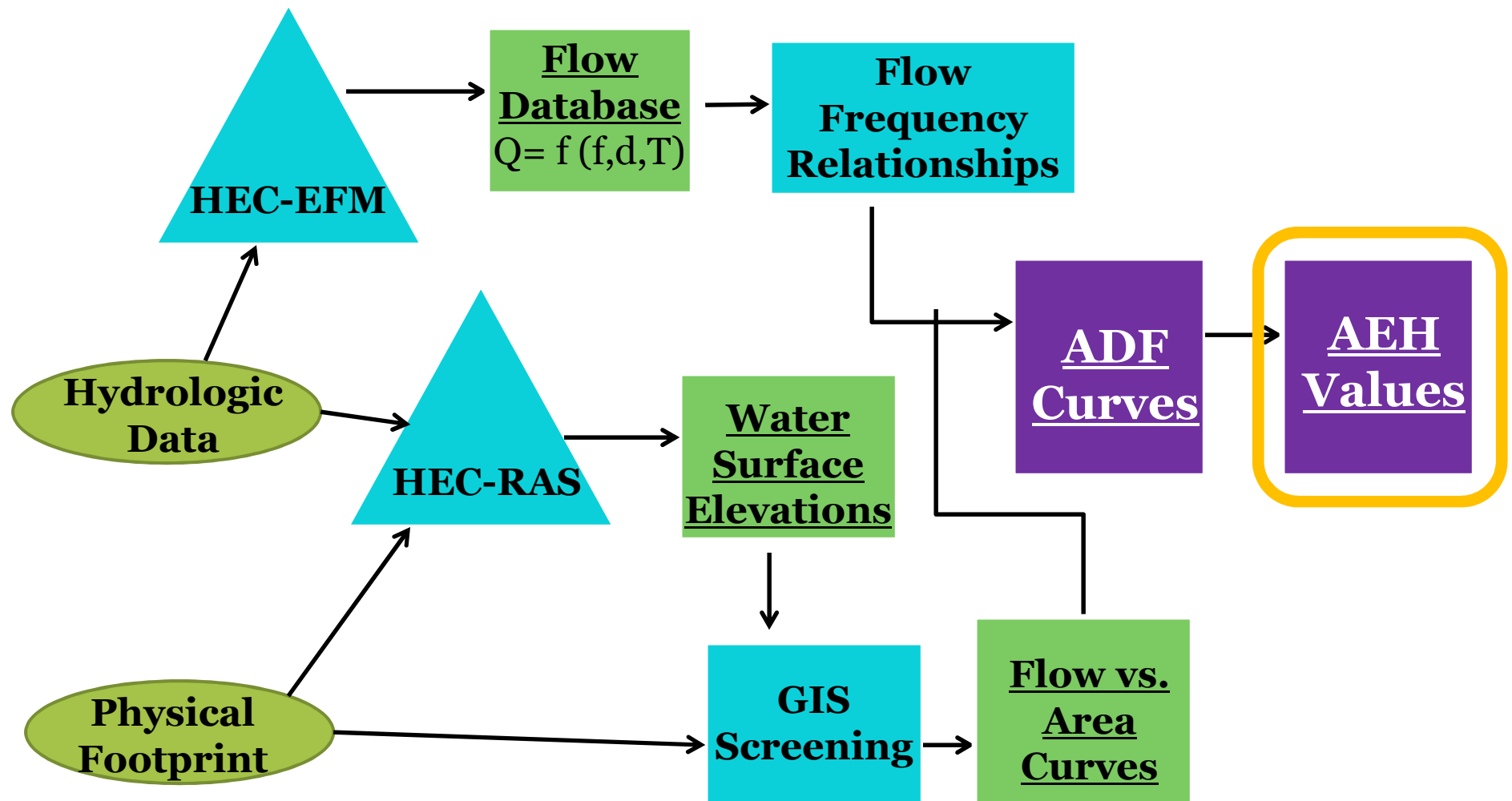
Alternative



ADF Curves: Species Specific



Method Flow—Output and Results



EAH Value: Definition

Estimated Annual
Damage in Flood
Risk Analysis }

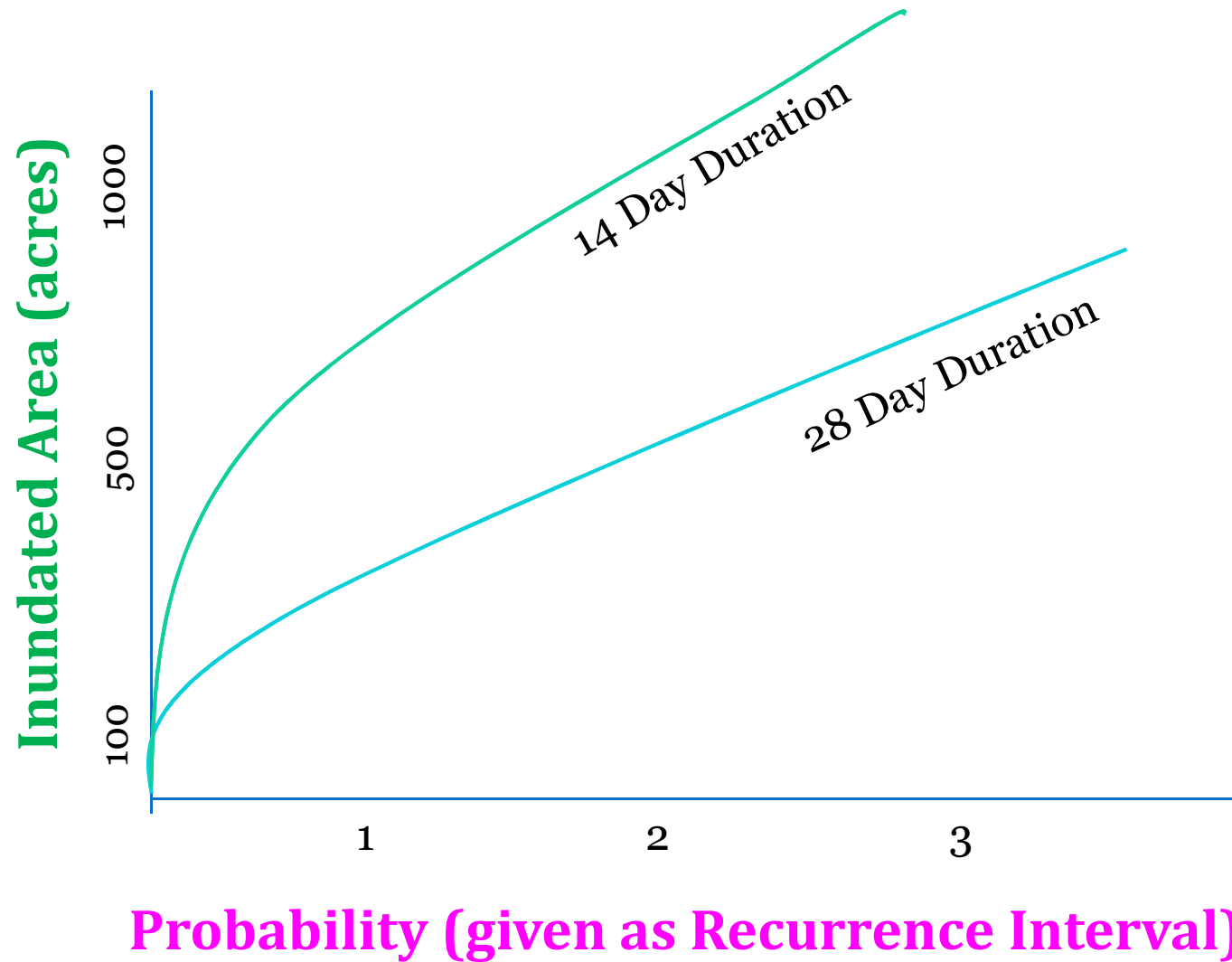
Defines the total
(negative) risk in an
area as an annual
monetary loss.



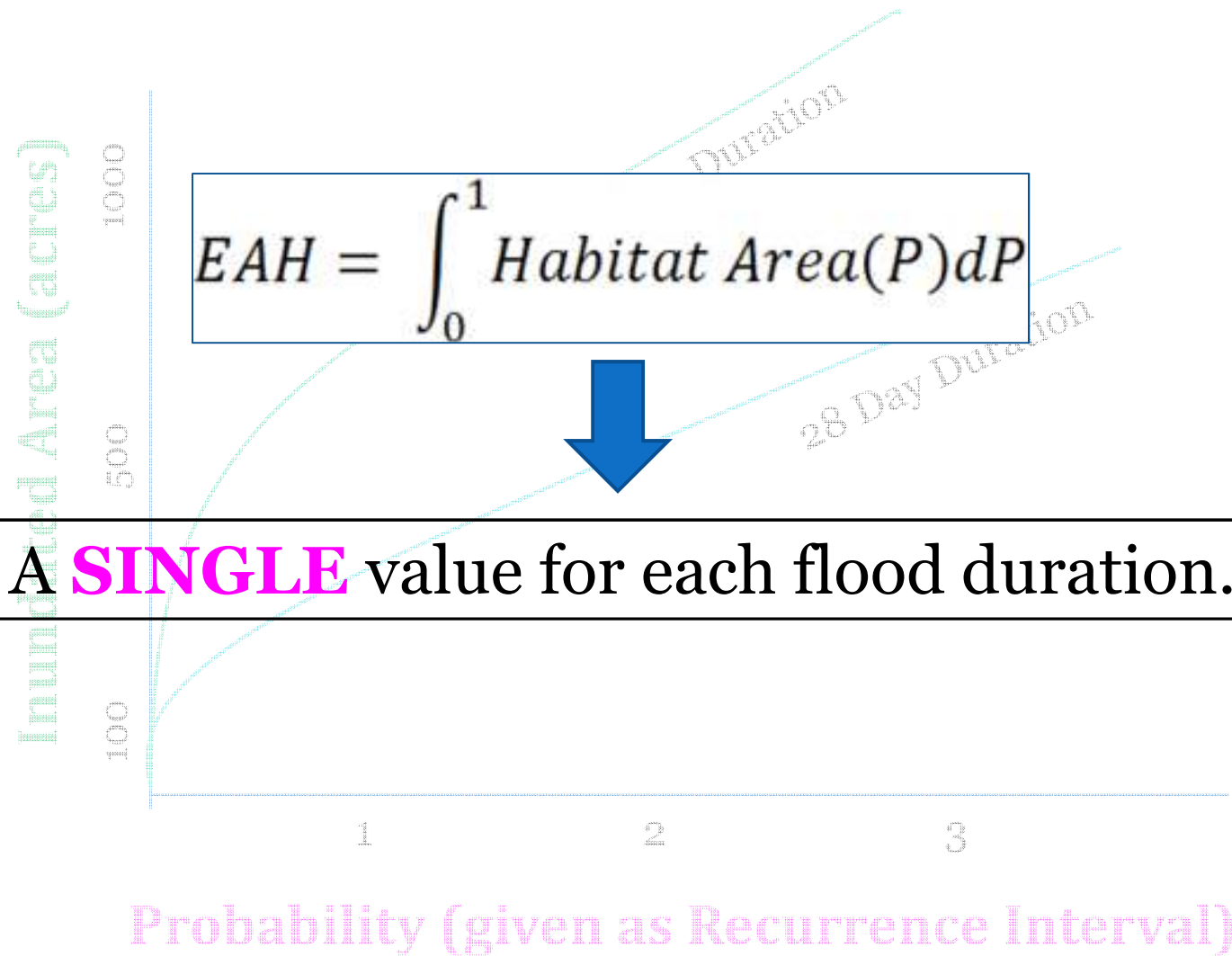
Estimated Annual
Habitat }

Defines the total
(positive) risk in an
area as an annual
habitat gain.

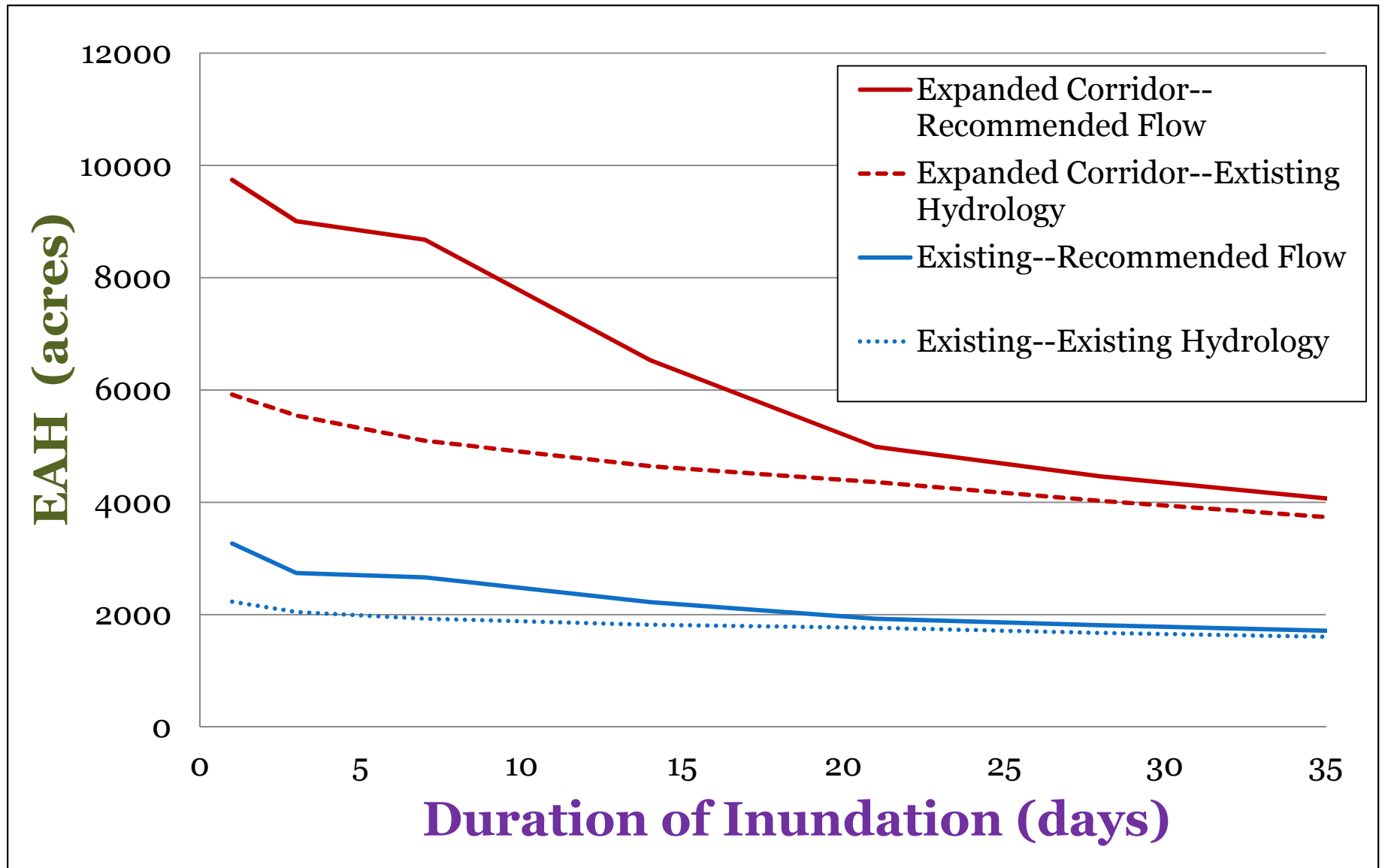
Develop EAH



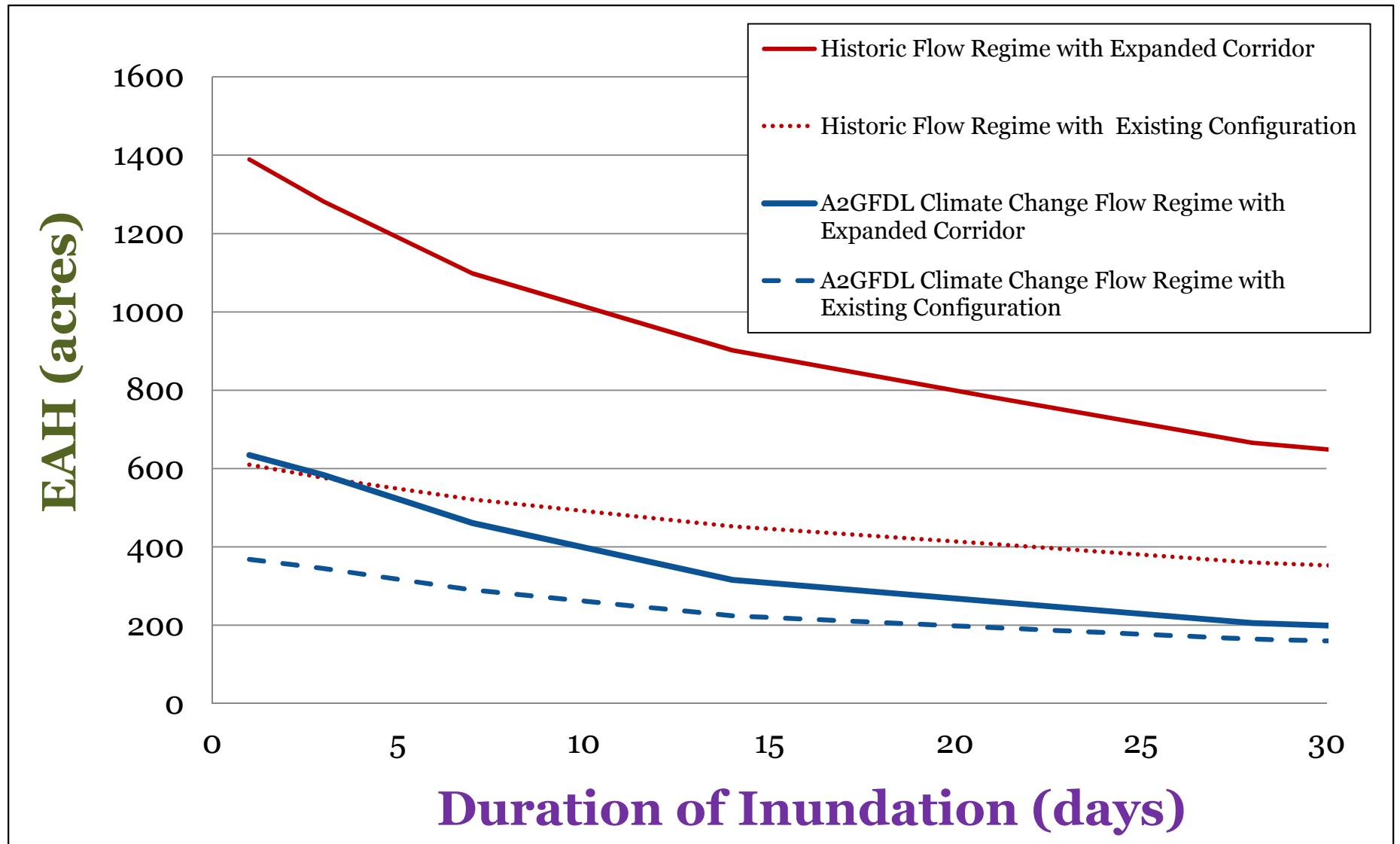
Develop EAH



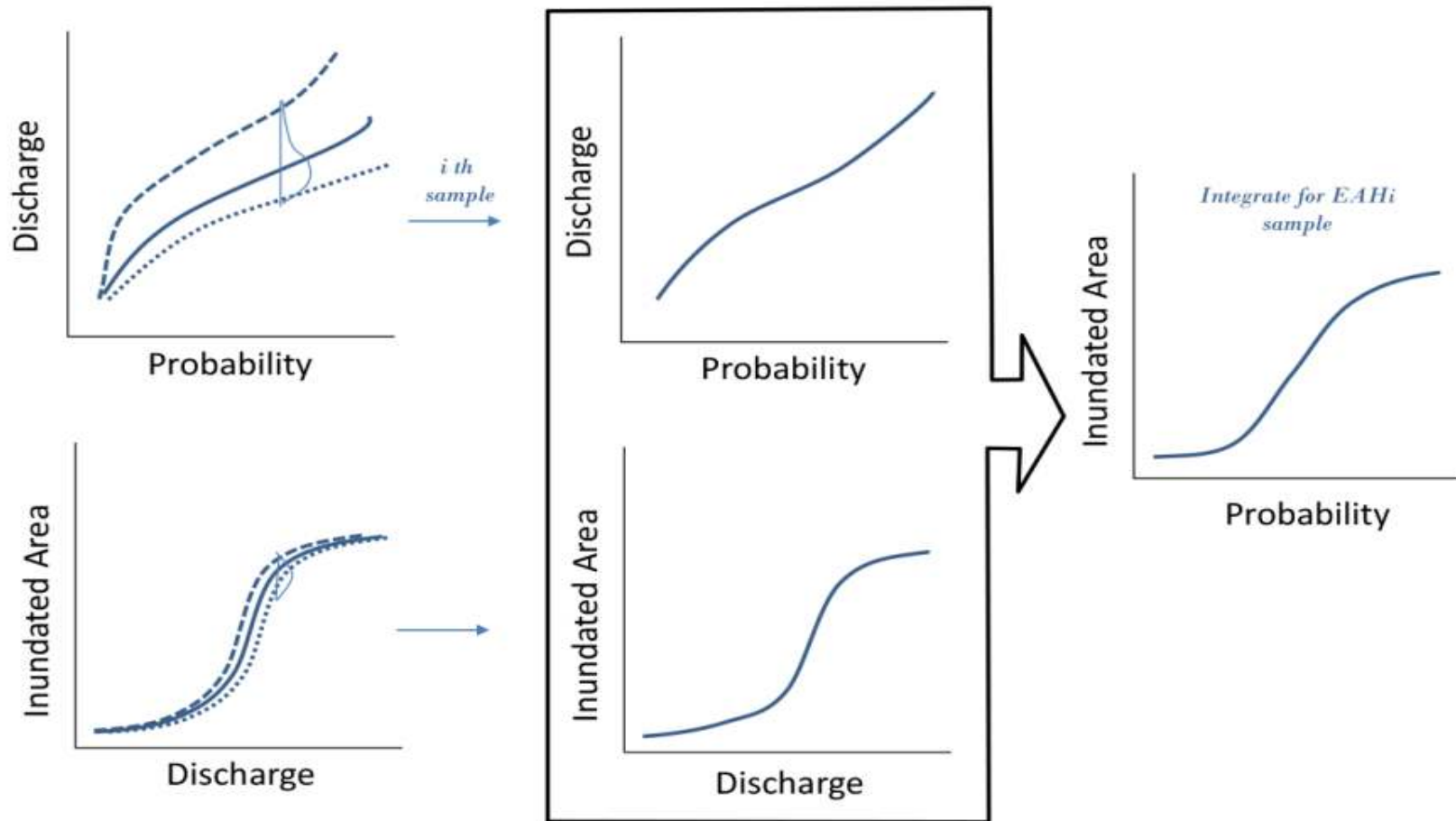
EAH Results



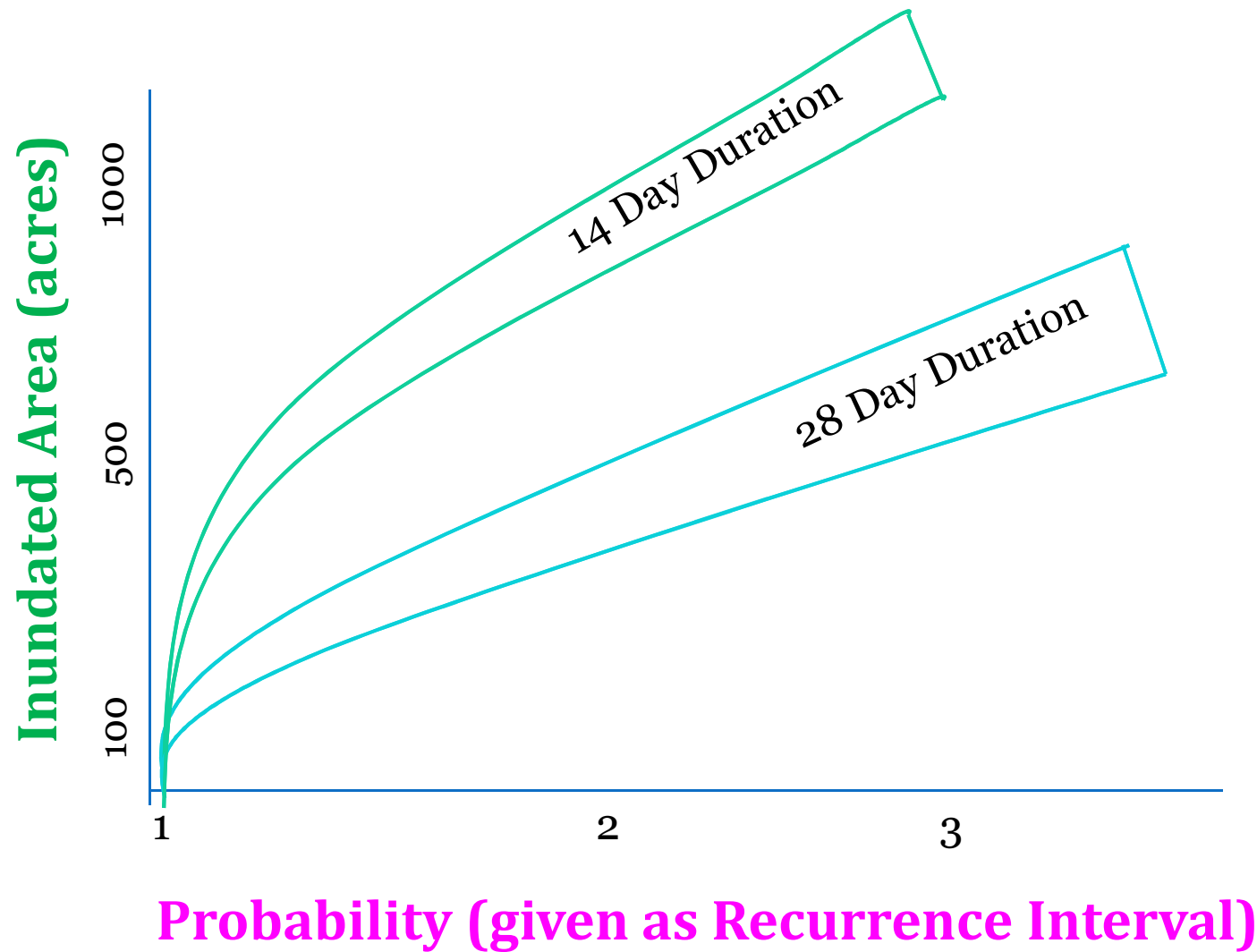
Climate Change EAH



Uncertainty?



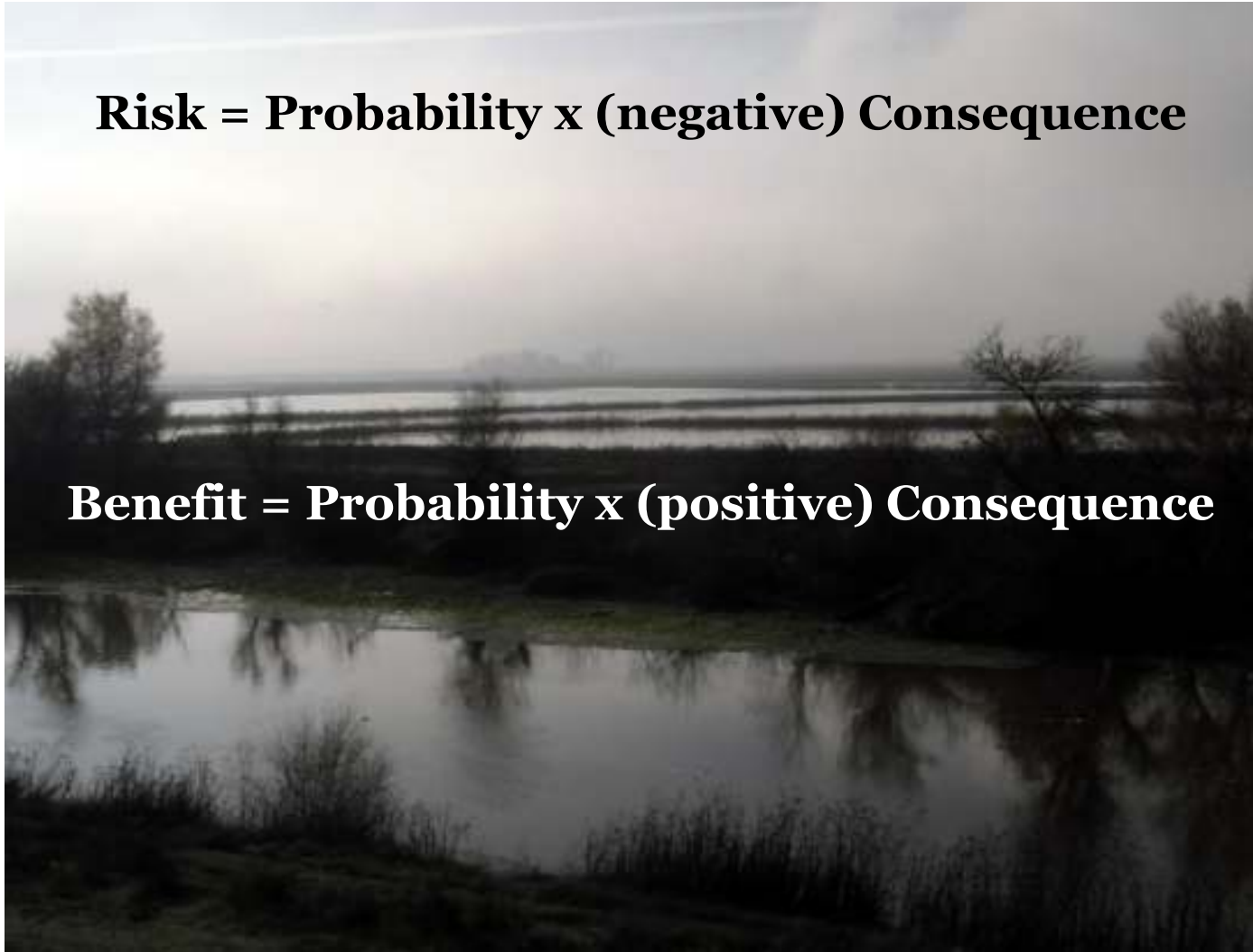
Uncertainty



Assumptions: Benefit as Risk

Risk = Probability x (negative) Consequence

Benefit = Probability x (positive) Consequence



Assumptions: functional habitat...?

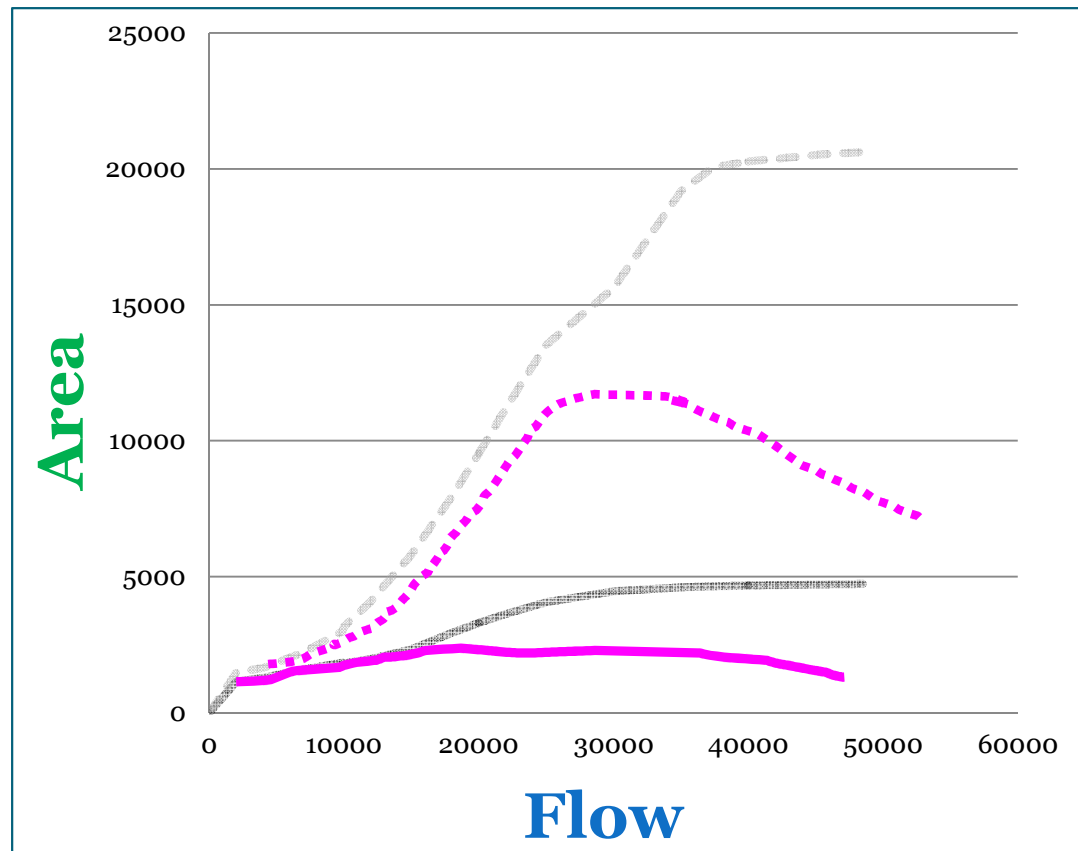
Physical

- Area

- ✓depth
- ✓velocity
- ✓cover
- ✓vegetation
- ✓connectivity

Hydrologic

- Duration
- Frequency
- Timing



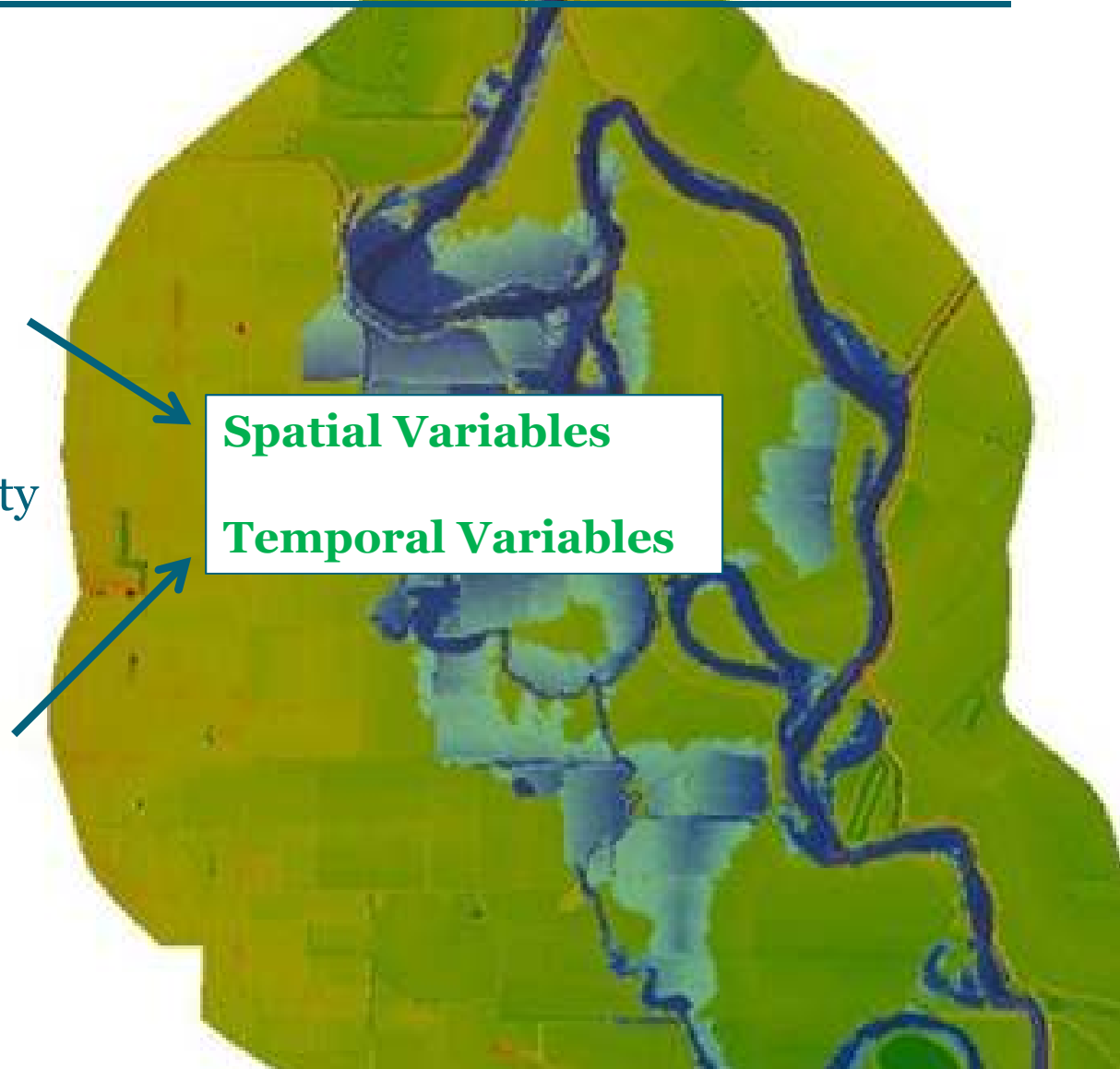
Assumptions: functional habitat...?

Physical

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Flexibility

Physical Alterations

- Levee setbacks
- New bypasses
- Floodplain grading
- Weir and grade control structures
- Dredging
- Side channel reconnection

Hydrologic Alterations

- Weir Notching/lowering
- Reservoir Operations
- Climate Change



Regional Applications—Valley Wide



Questions?



American Rivers
Rivers Connect Us

